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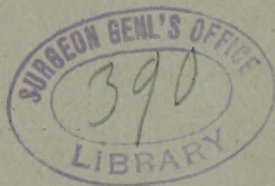
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## OBSERVATIONS ON TUBERCULOUS KNEE- JOINT DISEASE IN CHILDHOOD.

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It is a well-established fact that the great majority of chronic joint affections in childhood are tuberculous in character, and that the bacillus coming from without is not primarily, or with rare exception only, deposited in the joint. Koenig in sixty-seven autopsies on individuals affected by tuberculosis of bones and joints, found in fifty-three instances older foci of disease which might be considered the seat of the original infection. The autopsies reported by Northrup, Bollinger, and others, have shown that this primary infection is in most instances of the bronchial or mesenteric glands where it may lie dormant in persons of apparently perfect health. Ziemssen in calling attention to the fact that tuberculous disease so often follows measles says, "the infection of measles has not excited tuberculosis, but has only made the latent tuberculosis manifest." Krause has proved that it is possible in previously inoculated animals to produce local tuberculous disease by spraining joints.

It seems fair to assume then that the sequence of events in a tuberculous joint disease, may be somewhat as follows: By inheritance the patient may be in a vulnerable condition; whether or not inheritance has a more direct bearing than this we are at present unable to determine. The bacillus coming from without finds lodgment probably in the bronchial or other lymphatic glands and a state of latent tuberculosis is established. Later a congestion, the result of injury to a joint, forms a favorable nidus for the deposition and growth of the bacilli, and the resulting joint affection is thus a local manifestation of a disease of longer standing. While it is not probable that these inferences are strictly true in all cases, the theory is clinically correct, for it emphasizes the importance of general

therapeutic, as well as local treatment, of nourishing food, and above all of open air and exercise, as opposed to long confinement in bed. It shows also why early excision of a diseased joint, as urged by those who exaggerate the local malignancy of the tuberculous processes in childhood, may not entirely remove the disease or its predisposition to recur. On the other hand, the presence of a painful joint with long-continued supuration, from its depressing influence on the health of the patient may make an operation for the removal of the local affection imperative, although we may not hope to entirely eliminate all the foci of disease from the body. It is well known also that the age of the patient has a most important bearing on prognosis and treatment. It is not at all infrequent to see children suffering from several local manifestations of tuberculosis who are in good physical condition, while in the adult, disease of a single joint may call for early and radical operation.

It must therefore be borne in mind that these remarks refer to disease of childhood only. In knee-joint disease we know that the tuberculous process is at first usually confined to the epiphysis, femur or tibia, that its growth is favored by the congestion of traumatism. During the first stage certain sympathetic changes take place in the joint itself tending to impair its usefulness, and later we may expect a breaking through into the joint with more or less diffuse tuberculous disease there, unless we are able to check the progress of the primary affection. If then we might accurately determine the position of the limited disease in the epiphysis, we might hope to remove it; practically this is not often possible without the destruction of much bone on which the future growth of the limb depends.

We are therefore restricted to what may be termed symptomatic treatment:

To provide when possible the best environment for the patient.

To remove pain and the apprehension of pain.



To furnish an apparatus which will allow the patient unrestricted exercise in the open air.

To remedy and prevent deformity.

If pain is not relieved, temporary confinement in bed for rest extension and local treatment is indicated.

If observation shows that the disease is extra-articular it may be removed, abscesses may be aspirated and iodoform-emulsion injected.

The tension of acute articular inflammation may be relieved by free incisions. The distension of the knee-joint by pus or the pus-like product of tuberculous inflammation should not be permitted, because of the danger to the cartilage which rapidly disintegrates under these conditions, exposing the healthy bone to the invasion of disease. If the disease is progressive the joint may be freely opened and all tuberculous soft parts removed, including those in the bone itself, partial and complete excision being reserved as last resorts and as distinctly life-saving operations by which we sacrifice the usefulness of the limb to present necessity.

Under proper treatment radical excisions are rarely indicated. The record of 300 final results in knee-joint disease collected by Gibney, after efficient treatment, improper treatment, and neglect, show that the death-rate immediate or remote is less than ten per cent. ; and even under these adverse circumstances that the ultimate condition of the joint as to usefulness and functional ability is surprisingly good. We are therefore encouraged to hope that early diagnosis and efficient treatment will greatly improve on these results. The plea for early excision, that we may thus entirely remove a malignant disease, is invalidated by the probable presence of the bacillus elsewhere in the body, or in other words, there may be a constitutional predisposition to disease which cannot be removed by any operation. Life is endangered rather by the violence of the local affection or from the effects of long-continued suppuration, than by the mere local tuberculosis *per se*.

Even the modern operation of partial excision presupposes a stiff leg and complete atrophy of all the muscles which should move the joint, thus diminishing the blood supply of the limb on which the growth of the bone depends, while complete excision subjects the patient to an amount of shortening, which in latter life may make the leg a useless appendage. It would seem, therefore, that on the latter ground alone excision of the joint, except as a necessity should be limited to late adolescence and adult life, when the whole question assumes quite another aspect.

The fact that early excisions are so often performed emphasizes the importance of special institutions for the treatment of chronic joint affections, where the natural history of the disease, its duration, complications and effects on the limb and life of the patient is known, and where facilities for its proper treatment are provided.

Perhaps the strongest argument of the general surgeon, who is more familiar with neglected or advanced cases, or with the acute phases of the disease which brings the child to the hospital than with final results, is that by excision of the joint we may remove local disease and deformity and obviate the necessity of mechanical support and after-treatment. This is not borne out by facts. Hoffa investigated 135 cases of knee-joint excision, and in thirty-three per cent. found a recurrence of deformity, and in many local disease also, which accords perfectly with our experience here.

As the question of time and expense of apparatus is so often brought forward by those who would substitute excision for conservative treatment, it is well that we should know exactly how much time and how much expense is entailed upon the poor at this institution. As to time, a visit once in two or three weeks, for from one to three years, and an expense of from five to ten dollars a year for apparatus, which is furnished free of charge to those who are unable to pay.

It cannot be too strongly urged that knee-joint disease, properly treated, is not a painful or depressing affection. These children attend school and are more often endan-



gered by the violence of their play, than precluded from exercise by pain or deformity. That the ultimate results of treatment are favored by early diagnosis is clear. What are the elements of early diagnosis of knee-joint disease in children ?

First, chronicity : as children recover so quickly from any simple injury or disease the mere fact that a child has had something the matter with the knee for several weeks, is in itself a very suspicious symptom.

In the earliest stage then, possibly after an injury, we may expect slight pain at night after violent exercise, a little stiffness or limp sometimes noticed only in the morning. On examination, a slight limitation of motion particularly in extension, that is the ham strings are somewhat contracted, there may be a slight enlargement and a little increase in the temperature of the joint, tenderness on pressure often over the internal condyle and occasionally a subacute synovitis may be the prominent symptom.

The continued observation of joint affections in childhood and infancy impresses one with the importance of watchfulness. Any chronic affection no matter how slight, which shows a tendency to deformity or to limitation of normal motion, demands protection, no matter what the ultimate diagnosis may be.

By treatment in the earliest stage we may hope to check the progress of the disease ; to entirely prevent deformity ; to preserve motion ; to prevent and modify the sequelæ of the disease, abscess, long-continued suppuration, and its effects. The essentials of proper treatment are :

1. To overcome deformity and place the limb in a straight line. The growth is so rapid in early childhood, especially under the stimulus of an inflammatory process that permanent distortion may quickly follow on continued faulty position.

2. To fix the joint by plaster-of-Paris, extension or otherwise.

3. To apply a brace which shall entirely prevent the functional use of the limb and insure protection from traumatism.

By protection and fixation we guard against the liability to active or passive congestion which favors the increase of local disease, and while we may not always expect to confine it to the epiphysis we may hope to check the rapidity of its progress until the sympathetic inflammation in the joint has shut off a healthy portion by connective tissue, so that the subsequent tuberculous process may be limited in extent. In this way we explain the nearly perfect motion which may ultimately be preserved even after involvement and suppuration of the joint itself.

The apparatus which in out-patient practice at least, best fulfils the necessary conditions is what is known as the Thomas knee-brace. It consists of a padded ring surrounding the upper part of the thigh on which the tuberosity of the ischium rests, and the lateral rods terminating in a foot-piece three inches below the foot, on which the patient walks, with the aid of a high shoe or patten on the sound side, we are thus able to dispense with crutches which are very unsatisfactory for children who cannot be closely watched. Complications are then treated as they arise in the manner already indicated.

In the more advanced cases, when deformity is well marked, the patients are admitted to the hospital and the position is corrected and abscesses or suppurating sinuses treated as a preliminary measure. Protective treatment is then continued until there is no longer evidence of disease, and until there is no further tendency to recurrence of deformity. Time is of no particular importance compared with ultimate results, which we hope and expect to attain.

Several clinical cases may now be presented to illustrate some of the points touched upon.

*I.—Early diagnosis of knee-joint disease in infancy ; persistent treatment and cure.*

A well-developed infant of six months was brought to the hospital on October 8, 1890, with a history of stiffness of the left knee of one week's duration. There was no known cause, no pain or discomfort. The watchful mother had



noticed that the child did not extend the leg, and wished to have the symptom explained. Examination showed the joint absolutely normal in appearance; no heat; no increase in size; no atrophy of the leg; there was slight limitation of flexion, and extension was impossible beyond 160 degrees; within this limit motion was painless. As the child did not walk, various short braces with and without extension were applied with the aim of overcoming the flexion, but were inefficient. Two months latter a very light Thomas brace with extension was applied which quickly overcame the deformity. Complete rest and protection was kept up for one year, when the brace was removed tentatively at night, and finally discarded.

Now at the age of two years the condition of the joint is normal in every way and motion is unrestricted. Measurements, however, show the affected limb to be three-quarters of an inch longer than its fellow, which proves that there was an irritative process about the epiphysis of the femur, and confirms the original diagnosis.

II.—*Early diagnosis of knee-joint disease confirmed by another tuberculous focus in the spine.*

A child of three years was brought to the hospital on August 14, 1891, with an indefinite history of slight pain in the knee on fatigue. Examination showed a slight thickening of capsule; slight creaking in the joint when moved, and limitation of extension at 175°. No enlargement; no heat; no pain on motion; three-quarters of an inch atrophy of the thigh. Thomas brace, with extension, was applied. On November 27, an irregularity of the spine was discovered in the lumbar region with all the accompanying symptoms of Pott's disease; the symptoms in the knee-joint being quiescent; no pain or spasm or local indication of disease. It seems probable that here we are dealing with two primary foci of disease, that in the knee having been first apparent, rather than with a transference from the affected knee to the spine.

III.—*Early diagnosis of knee-joint disease confirmed by neglect.*

An infant of eleven months was brought to the hospital on April 11, 1890, with a history of slight pain and stiffness in the right knee of two weeks' duration, following injury. Examination showed slight limitation of motion and pain on complete extension of the leg, a little enlarge-

ment of the knee and apparent tenderness on pressure over the internal condyle. There were several hard nodules in the subcutaneous tissue of the right leg. Plaster bandages were applied for several months. It may be noted here that plaster bandages or any simple support of this nature is unsatisfactory and inefficient even in infancy. In August the child had convulsions followed by right hemiplegia, and was transferred to a neurological clinic. In November the knee was said to be well. In January, 1891, she was again brought to the hospital the hemiplegia having entirely disappeared. The leg was fixed at an angle of  $135^{\circ}$ ; there was marked enlargement and thickening of the knee, with pain on attempted motion. A Thomas brace, with extension, was applied combined with firm bandaging and compression of the knee which rapidly brought the leg down to a straight line. This appliance has been continued for one year. The legs are now equal in length; the knees equal in size; a slight thickening of the tissue below the patella being the only sign of disease. The subcutaneous tuberculous nodules have disappeared, leaving depressed scars. The brace will be worn for several months, it will then be removed at night. If no symptoms follow the voluntary motion at the knee the child will be allowed to walk about a little in the morning and at night. Finally, all support will be removed under careful and continued observation.

IV.—*Tuberculous knee disease with constitutional symptoms; arthrectomy; recurrence under neglect; subsidence of disease under protection.*

An Italian child eighteen months old was brought to the hospital in August, 1890. The knee-joint was uniformly swollen, infiltrated and fluctuating, and the child was evidently suffering from severe constitutional disturbance. As the age limit would not permit her admission to this institution she was sent to the New York Hospital. Dr. Bull made two long lateral incisions on either side of the joint and all the soft parts were thoroughly removed. The disease was tuberculous in character. The wounds healed readily, and she was discharged some months later, the joint being freely movable in all directions, very loose and flail-like from the destruction of ligaments and other supporting structures. The parents failed to report for several months, and when the child was again seen there was recurrence of the deformity. The leg was flexed at about  $160^{\circ}$ , and could not be extended to a straight line; two sinuses had formed on either side of the joint.



A Thomas knee-brace, with extension, quickly brought the leg into good position; under protection the sinuses closed and the disease ceased to progress. After one year a simple lateral support was applied and the child allowed to walk on the leg. Now there is no evidence of disease or deformity. The leg can be voluntarily extended and flexed through an arc of  $20^{\circ}$ , the joint has become firm. The diseased leg is one inch longer than its fellow, and the prospect of a useful limb with no subsequent shortening seems very good.

V.—*Radical excision; recurrence of disease and deformity; subsequent osteotomy; great shortening.*

The patient's knee-joint was excised at the age of four, two years later he came to this hospital presenting the following condition: His leg was fixed in a position of flexion, with marked outward bowing and inward rotation of the tibia, several sinuses were still open and discharging. He was admitted to the hospital, osteotomies were performed and the leg brought to a straight line. Under treatment the sinuses closed, and he was discharged wearing a brace. In spite of persistent treatment deformity tends to recur, and at the age of eight years he has an actual shortening of four inches in the length of the leg. This disproportion in length will be progressive, and in later years may make the leg useless as a supporting member. This case is presented only to illustrate what we may expect from early and complete excision in regard to cessation of growth, and to show that this operation, as in this case performed by a skillful surgeon, may not remove the disease or prevent subsequent deformity.

VI.—*Partial excision; recurrence of disease; progressive deformity.*

A child of seven was brought to the hospital February 25, 1892, with the following history: Disease of the knee-joint at the age of three; no treatment; progressive deformity. One-and-a-half years ago he was admitted to a hospital and the operation of excision performed; the wounds closed and he was discharged four months later. In two months there was local recurrence, for which he was readmitted. Again discharged cured, and again admitted on three subsequent occasions at short intervals, for recurrence. He now presents the following condition: Firm union; numerous scars of sinuses and operation wounds; one inch actual shortening of the leg; marked

knock-knee ; paralysis of the anterior muscles of the leg and foot, with contraction of the tendo-Achillis. This case shows the importance of protective treatment after excision. It is probable that these recurrences, and certainly the knock-knee, might have been prevented by the use of a proper brace while the leg was in a vulnerable condition. The paralysis is probably due to division of the external popliteal nerve during the operation. The child will be admitted to the hospital where an osteotomy will be performed for the relief of the knock-knee, the foot brought up to a right angle and supported. Protective treatment will then be continued until there is no further tendency to recurrence of deformity.

VII.—*The ordinary course of knee-joint disease when untreated.*

A boy of nine is brought here on crutches. History: An injury to the right knee two years ago followed by pain, stiffness and deformity. Treatment: Anti-rheumatic remedies, liniments, etc. Progressive enlargement of the joint, and finally suppuration. Three months in bed in a general hospital where the abscesses were opened. An attack of measles, and one month at North Brother's Island ; progressive deformity and emaciation ; removal ; crutches, and exercise in the open air, followed by improvement in general condition. Examination: Leg fixed at an angle of  $135^{\circ}$  ; general enlargement of the right knee, with tenderness on pressure ; patella immovable ; two closed sinuses on the outer and one on the inner aspect discharging ; outward and backward displacement of the tibia ; the diseased femur is one inch longer than its fellow. The patient will be admitted to the hospital ; the position will, as far as possible, be corrected. A close-fitting plaster bandage and a Thomas brace will then be applied, and by persistent treatment the patient may be assured a useful limb.

In conclusion, it may be stated that scientific conservative treatment can be easily and effectually carried out, even among the poorest classes. One has only to compare the almost uniformly good results thus attained with the rigid, short, atrophied and often deformed limbs seen in later years as the result of early excision, to decide that this operation, performed on young children simply because the disease is tuberculous in character, or on the plea



that apparatus may thus be dispensed with, is unjustifiable. The principles of conservative treatment in brief are: To rapidly and completely overcome deformity; to hold the limb at perfect rest, protected from traumatism, and the limb in a straight line until a proper cure is established; complications to be treated on modern surgical principles. Under these conditions the occasion for excision or amputation must be rare indeed.







